HPS&ST NEWSLETTER

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The HPS&ST NEWSLETTER is emailed monthly to about 9,500 individuals who directly or indirectly have an interest in the contribution of history and philosophy of science to theoretical, curricular and pedagogical issues in science teaching, and/or interests in the promotion of innovative, engaging and effective teaching of the history and philosophy of science. The NEWSLETTER is sent on to different international and national HPS lists and international and national science teaching lists. In print or electronic form, it has been published for 40+ years.

The NEWSLETTER seeks to serve the diverse international community of HPS&ST scholars and teachers by disseminating information about events and publications that connect to concerns of the HPS&ST community.

Contributions to the NEWSLETTER (publications, conferences, opinion pieces, &.) are welcome and should be sent direct to the editor: Michael R. Matthews, UNSW (m.matthews@unsw.edu.au).

The NEWSLETTER, along with RESOURCES, OBITUARIES, OPINION PIECES and more, are available at the website: http://www.hpsst.com/

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The 16th Biennial International History and Philosophy of Science and Science Teaching Group (IHPST) Conference, Calgary, Canada. 3-7 July, 2022

Conference Theme: Energising Education with the History, Philosophy, and Sociology of Science

The province of Alberta is the oil-sands energy centre of Canada. It has been the locale for debate about fossil fuel usage, environmental impacts, renewal energy production, First Nations relations and much else.

Plenary Speakers:

- Dr. Alison Wylie, of the University of British Columbia, is a philosopher of social and historical sciences. She is currently President of the Philosophy of Science Association, and Past-President of the American Philosophical Association, Pacific Division. Dr. Wylie works on philosophical issues raised by archaeological practice, and by feminist research in the social sciences.
- Dr. Carol Cleland, of the University of Colorado Boulder and current Director of UC Boulder's Center for the Study of Origins, focusses her research on issues concerning scientific methodology (historical science vs. experimental science, the role of anomalies in scientific discovery), biology (microbiology, origins of life, the nature of life, and astrobiology), and the theory of computation. She is the inventor of the term 'shadow biosphere,' a subject on which she has written and lectured extensively.

- Optional field trips to Burgess Shale, Royal Tyrell Museum, and Frank Slide/Bellevue mine
- Original dramatic production, *Formations*, about four important women earth scientists, their discoveries and their experiences of being a woman in a male dominated career field. Written by Meg Braem and directed by Christine Brubaker
- Graduate student Summer School session
- Undergraduate virtual poster presentation
- Practicing teacher symposium
- Conference dinner at Heritage Park

First call for abstract submission for early decision- 31 October 2021–15th December 2021

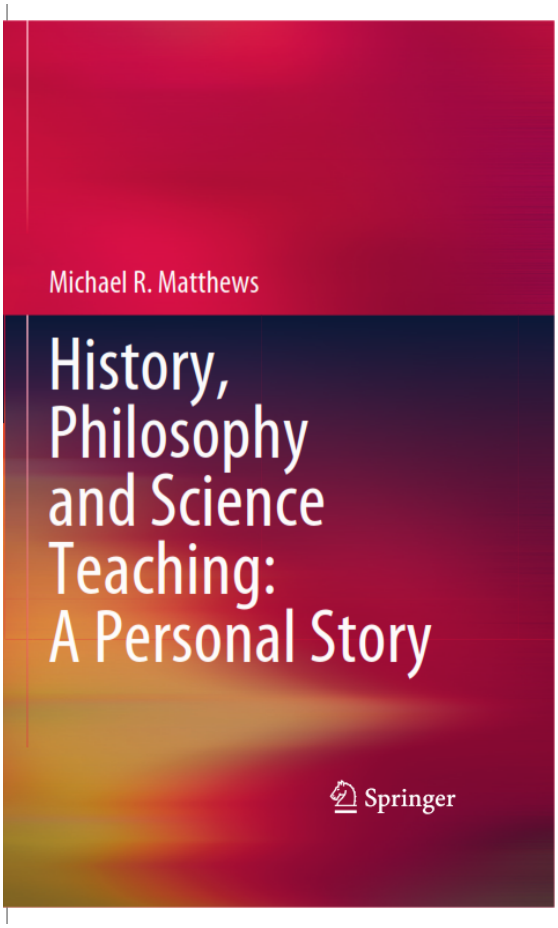
Last call for abstract submission - 28 February 2022 - decision until 30th March 2022

Because of the ever-evolving COVID-19 situation, the conference will be a hybrid event. Presenters not traveling to Calgary can submit a pre-recorded presentation that will be played live during the appropriate session. Remote presenters can attend, synchronously, via Zoom (most likely) to answer questions. For a reduced registration fee, remote conference participants can gain access to sessions as they are happening.

Conference will also feature dedicated sessions to the following issues: Racial justice/decolonization; Accessibility; Gender equality.

Please visit www.ihpst.net for submission instructions and further information.

Review: History, Philosophy and Science Teaching: A Personal Story (Springer 2021)



Lima, Nathan Willig: 2021, 'Michael Matthews and the Development of History, Philosophy and Science Teaching: Thirty Years after 'The Present Rapprochement'", *Review of Science, Mathematics & ICT Education*, 15(2), 1-21.

The review is available as a pdf file here.

The book's Contents, Introduction and Name Index is available here.

Royal Society Biographical Memoirs

The Royal Society is a learned society and the United Kingdom's national academy of sciences. Since 1932, the Royal Society has been publishing extended obituaries of its Fellows and Foreign Members. *The Biographical Memoirs* are recognised as definitive accounts of the life and work of these eminent scientists, providing a valuable resource for both scientists and historians of science. All memoirs have been **free to read online** since 2020, including those on Alan Turing, Stephen Hawking, Francis Crick and Dorothy Hodgkin.

Each memoir is carefully researched and creatively written, usually by a close colleague or research collaborator. The main focus is the science and scientific endeavour, but the memoirs also offer a fascinating insight into the character and personalities of the individuals involved. Readers can discover how the science was achieved within the historical context, and follow the development of specific scientific disciplines and fields of research.

These memoirs provide a rich and unique resource to supplement undergraduate and post-graduate teaching and seminars. Students will benefit from understanding how their research field has developed, and be inspired by the stories of those who have succeeded before.

Royal Society Biographies.

University of Leeds, History & Philosophy of Science Online Seminar Series, Spring 2022

Wednesdays 3.15-5pm GET (except on May 11th)

February 23rd Sarah Qidwai (Regensburg) 'The Communication of Scientific Knowledge in British India: Investigating Local Actors as Science Popularizers'

March 16th Jennifer Jhun (Duke) 'The Science of Antitrust'

March 23rd Nina Emery (Holyoke) 'From Content to Methodology: Extending Naturalism Beyond the Limits of Science'

April 27th Fati Fan (Binghampton) 'All Eyes, All Ears, All the Time: Environmental Monitoring, Sensory Experience, and Political Epistemology in Communist China and Beyond'

May 11th Chris Lean (Sydney), 'The future role of synthetic biology in conservation' *N.B.* at 11 am GMT

Join us on Zoom for these seminars, here.

For further information, please contact the Director of the Leeds HPS Centre, Dr Ellen Clarke: e.clarke@leeds.ac.uk

Science & Education Open Access Articles

Science & Education journal currently has 73 HPS&ST articles available gratis as Open Access. These can be seen and individually downloaded here.

HPS&ST in Latin America

- Charbel El-Hani and Cláudio R. M. Reis, who teach History and Philosophy of Biology at the Federal University of Bahia, Brazil, has began sharing classes from a course they offer to undergraduate students. These are short and basic classes on central issues in History and Philosophy of Science and Biology, with English subtitles.

  The first one can be found here and at the resources folder of the HPS&ST website.

- *Caderno Brasileiro de Ensino de Física* (a Brazilian Physics Education journal founded in 1984) is now accepting papers on Physics Education and Science Education written in English, Spanish and Portuguese. The journal publishes three issues a year and it displays a special section for papers on History, Philosophy and Sociology of Science and Science Education. The journal editors invite the researchers of HPS&ST community to submit their manuscripts to be considered for publication. Moreover, they invite researchers who may be interested in evaluating submitted manuscripts to register in the journal system. Information may be found here.

- Events

  XX IOSTE Symposium (International Organization for Science and Technology Education) will be held in Federal University of Pernambuco and Mar Hotel Conventions, Recife, Brazil, from July 25th to 29th. The theme of the event will be 'Esperançar in uncertain times: the role of science and technology education in/for a changing world', an allusion to Paulo Freire's concept of Esperança ('hope'). The event presents a special strand for submissions of HPS&ST field. Information is available here.

  The sixth Escola Paranaense de História e Filosofia da Ciência was held virtually from November 23rd to November 26th. The main course, offered by Andrew Feenberg (Simon Fraser University - Canadá) and Bernadette Bensaude-Vincent (Université Paris 1 - França) is available here.

- Publications

  Revista de Enseñanza de la Física has just published a special issue with publications from the XXII REF (Reunión de Educación en Física). The papers are available here.

- RIEC's Epistemology and History of Science Study Group

  Red Internacional de Investigación en Enseñanza de las Ciencias (RIEC, (International Network for Science Teaching, in a free translation) has the general purpose of favouring the inter-relationship between different institutions and graduate programs to expand research strategies, innovation, socialisation, and graduate development at an international level. It is currently made up of more than 20 institutions from different research groups and Graduate Programs from four different countries, namely: Argentina, Brazil, Chile, and Colombia.

  Information about the research network may be found here and here.

Do you have any contributions about HPS&ST in Latin America?

If you have any information about events, publications, research groups, books about HPS&ST in Latin American and want to submit a brief note to be published in the HPS&ST Newsletter, please contact first Nathan Lima here or secondly Michael Matthews here.

East European Network for Philosophy of Science (EENPS) 2022 Conference

The East European Network for Philosophy of Science (EENPS), in co-operation with the Institute of Philosophy and Semiotics, University of Tartu, announces the fourth conference of East European Network for Philosophy of Science in Tartu on 17-19 August 2022.

Keynote Speakers

Helen E. Longino, C.I. Lewis Professor, emerita (Stanford University)
Tarja Tellervo Knuuttila (University of Vienna)
Lukáš Bielik (Comenius University Bratislava)

Please submit your abstracts and proposals for symposia via EasyChair by **31 March 2022**.

We invite submissions of contributed papers and symposia proposals related to any of the following areas:

a General Philosophy of Science

b Philosophy of Natural Science

c Philosophy of Cognitive and Behavioural Sciences

d Philosophy of Social Sciences

e History, Philosophy and Social Studies of Science

f Formal Philosophy of Science and Philosophy of Mathematics

Call for Contributed Papers

Authors are invited to submit extended abstracts (500-1000 words) + short abstracts (up to 100 words) as a .pdf file prepared for blind review through EasyChair. The abstracts should be headed by the title of the corresponding section (a – f), the title of the paper, and 3 to 5 keywords.

Local Organising Committee

Endla Lõhkivi (Chair), Jaana Eigi, Riin Kõiv, Kristin Kokkov, Eveli Neemre, Katrin Velbaum (all University of Tartu), Peeter Müürsepp (Tallinn University of Technology)

Programme Committee Chairs Sorin Bangu (University of Bergen) and Vlasta Sikimić (University of Tübingen)

Opinion Piece: From conceptual change to scientific imagination: An interdisciplinary workshop at the crossroads of HPS and science education research

Paul Alstein (Utrecht Univristersity)
Magdalena Kersting (University of Oslo)
Sam Rijken (Erasmus University Rotterdam)
Lukas Verburgt (Netherlands Institute for Advanced Study)

Paul Alstein is a PhD researcher at Freudenthal Institute, Utrecht University. His research project focuses on special relativity education at the secondary level. He is also appointed as physics teacher in teacher education at Utrecht University of Applied Science. Website: https://www.uu.nl/staff/PAlstein

Sam Rijken studied physics and history and philosophy of science at Utrecht University. Currently, he is a PhD candidate at Erasmus School of Philosophy, where he researches the role of the imagination in the production of scientific knowledge.

Magdalena Kersting is an educational researcher, physics educator and science communicator based at the University of Oslo in Norway. She took degrees in physics and mathematics at Georg-August-Universität Göttingen, and her PhD in physics education at University of Oslo. In her work, Magdalena uses perspectives of history and philosophy of science to enrich science education practices. She has a particular interest in Einsteinian physics education and is the main editor of Teaching Einsteinian Physics in Schools (Routledge). Website: https://www.magdalenakersting.com

Lukas M. Verburgt is fellow of the Netherlands Institute for Advanced Study (NIAS) and guest researcher at the Institute of Philosophy, Leiden University. He has held visiting research positions at Trinity College, Cambridge, and the Max Planck Institute for the History of Science, Berlin. His research focuses on the changing relationship between science and philosophy in the 19th and early 20th centuries. Website: https://www.lukasmverburgt.com

Introduction

On June 4th 2021, the Freudenthal Institute and Descartes Center (Utrecht University) hosted an online interdisciplinary workshop on conceptual change. The main aim of the workshop was to reflect on various aspects of conceptual change by bringing together scholars from the fields of history and philosophy of science (HPS) and science education. The workshop included eight talks by an equal number of HPS scholars and science education researchers, including keynote lectures by Stella Vosniadou and Paul Honingen-Huene. In this article, the workshop organisers (Alstein and Verburgt) and two of its speakers (Kersting and Rijken) present their reflections on the workshop and the resulting cooperation.

Although it is widely recognised that HPS and science education researchers have much to offer each other, their potential collaboration is often

hampered by differences in disciplinary traditions and terminology. As a result, while HPS scholars and science education researchers may be working on the same problems, insights yielded in one discipline often remain unexplored in the other. One way to bridge this divide is to identify shared topics of interest that lay the ground for joint exploration and fruitful collaboration. The present authors are convinced that such collaboration makes necessary a shared vocabulary in which insights from both disciplines can be expressed and communicated to each other.

Conceptual change is a paradigmatic example of such a shared topic across HPS and science education (Vosniadou, 2008). In HPS, conceptual change refers to the adjustment, re-evaluation and increased understanding of 'the scientist's conceptual apparatus' (Kuhn, 1966, p.242). Much emphasis in contemporary HPS is laid on the "practices of scientists in creating conceptual change, not on the conceptual structures per se" (Nersessian, 1998, p.160). In science education, most research in conceptual change describes students' difficulties and progressions in establishing scientific concepts by adapting an individual perspective, although conceptual change can be approached from social perspectives too (von Aufschnaiter & Rogge, 2015). During the workshop's (keynote) talks and plenary discussions, the workshop participants used the central topic of conceptual change to learn from each other and explore the relationship between HPS and science education research.

In particular, the workshop focussed on the following questions:

- How have HPS and science education research informed and influenced each other's views on conceptual change over the past decades until the present?
- What is the relation between recent debates in HPS and science education research on theories and models of conceptual change?
- What is required to make respective insights into conceptual change of mutual benefit?

In this article, we build on and extend our joint reflections to describe how discussing the notion of conceptual change has led us toward the topic of *scientific imagination*. As we will indicate below, both scientists and students seem to draw extensively on imagination and imaginative practices during processes of conceptual change. We argue, therefore, that the scientific imagination can be used as a key concept to answer the questions posed during the workshop. We will particularly indicate how recent insights from HPS and science education research into the notion of scientific imagination may be fruitfully combined to increase our understanding of conceptual change in science and science education.

Question 1: Looking back

Let us start by addressing the first question: how have HPS and science education researchers informed and influenced each other's views on conceptual change over the past decades until the present? It appears that the interaction between HPS and science education research has hitherto at best been asymmetric. Asymmetric because the influence appears to be mainly in the direction from HPS to science education, not the other way around. In her talk at our workshop, for example, Stella Vosniadou made the following remark:

> HPS-based conceptual change research has led science education researchers and educators to ex-

> amine more closely the nature of students' knowledge base – their preconceptions, misconceptions, and alternative conceptions – illuminating the failures of traditional approaches of teaching science to bring about science understanding. It has produced a much richer picture of the many conceptual changes – in ontology, epistemology, in representations of the world – as well as in basic cognitive and metacognitive capabilities students need to develop in the process of learning science. It has created a revolutionary shift in teaching science, from focusing on the transmission of facts to an appreciation of science as a discipline, of the scientific method, and of science's contributions to society. (Vosniadou, abstract for workshop)

One essential skill that students need to develop in science learning was mentioned repeatedly during the workshop: adequately employing imagination to bring about conceptual change. Floor Kamphorst, for example, described in her talk how secondary-school students reason scientifically through hypothetical modelling. In special relativity education, students perform the imaginative act of thought experiments to explicate their pre-instructional models of light propagation. In tasks, students relate these pre-instructional models to historical notions of light propagation: Newton's idea of light as tiny particles and Huygens wave description of light. Students can then build on these notions to understand the light postulate (Kamphorst et al., 2021).

Relatedly, Sam Rijken argued in his talk how a Waltonian view of the scientific imagination (discussed below) enables us to construct and present thought experiments in science education with increased precision and clarity. Magdalena Kersting, for her part, drew on Bertrand Russell's (1925, p.9) observation that learning general relativity demands a change in our imaginative picture of the world: "A change in our imagination is always difficult, especially when we are no longer young. The same sort of change was demanded by Copernicus, who taught that the earth is not stationary, and the heavens do not revolve about it once a day."

Question 2: Towards scientific imagination

Concerning the second question - what is the relation between recent debates in HPS and science education research on theories and models of conceptual change? - we believe that the concept of *scientific imagination* illuminates a relevant relation between recent debates in HPS and science education research.

The HPS contributions at the workshop reflect a recent trend in the field: the epistemic role of the imagination in science is currently being actively studied in the context of scientific modelling and thought experimenting. The recent collection *The Scientific Imagination* (2020) is exemplary in this regard[1]. Consider the following passage from its introduction, which echoes Vosniadou's statement above:

> Despite its centrality, the imagination has rarely received systematic attention in philosophy of science. This neglect can be attributed in part to the influence of a well-known distinction between the context of discovery and the context of justification (Reichenbach 1938), and a tendency in positivist and post-positivist philosophy of science to set aside psychological aspects of the scientific process. That

[1] In a recent review, Meynell writes justly: "'The Scientific Imagination' is, in some ways, an odd name for the book as the real focus is on scientific models (SMs) and thought experiments (TEs). TEs and SMs are types of representational objects, so focusing on them tends to elide other subjects that naturally belong in a discussion of scientific imagination—such as creativity, aesthetic value, or the role of emotions in science. " (Meynell, 2021, p.1)

> situation has now changed, and a growing literature in the philosophy of science is devoted to the role and character of imagining within science. This has been especially visible in the literature on scientific modeling, but the interest now extends more broadly. (Scientific Imagination, p.5)

This article discusses two branches in the HPS literature on imagination, both of which connect to science education research. The branches correspond to a distinction that is commonly made between two different *types* of imagination: *objectual* imagination and *propositional* imagination (e.g., Levy & Godfrey-Smith, 2020, p.5-6; Liao & Gendler, 2020, §1.2; Salis & Frigg, 2020, p.26). Objectual imagination is often discussed in connection to the scientists' context of discovery which, as we will indicate below, has a clear parallel to the students' context of learning science. Propositional imagination is currently mainly discussed through the concept of *make-believe*–an explicitly social type of imagination that complements the increased focus in science education research on the social aspect of imagination in the classroom, which we also discuss below.

2.1. Objectual imagination in HPS

Objectual imagination is the type of imagination that we intuitively associate with a "perception-like engagement with the [imagined] content in question" (Levy & Godfrey-Smith, 2020, p.6). This type of imagination is typically analysed with conceptual frameworks that draw explicitly on contemporary cognitive psychology[2]. We briefly mention the work of one influential author. Nancy Nersessian (e.g., 1992, 2007, 2008) has analysed the cognitive underpinning of conceptual change in science using the compelling notion of *mental modelling*: the imaginative manipulation of a mental analogue of a real-world object or phenomenon. Indicatively, Nersessian mentions that such "mental transformations are often accompanied by [for example] twisting and moving one's hands to represent rotation, which indicates motor as well as visual processing" (Nersessian, 2018, p.315). As mentioned below, such embodied aspects of the imagination are currently studied in science education.

There exists a noteworthy recurring link between HPS and science education research concerning objectual imagination. On multiple occasions, Nersessian has related her insights on scientists' conceptual development to the conceptual change that occurs when students learn scientific concepts:

> Clearly, one would expect differences between, for example, the practices used by scientists in constructing new concepts and students learning new (for them) concepts. For one thing, scientists have articulated theoretical goals and sophisticated metacognitive strategies while children and students do not. However, in conceptual change processes, a significant parallel is that each involves problem-solving. One way to think of learning science, for instance, is that students are engaged in (or need to be enticed into) trying to understand the extant scientific conceptualisation of a domain. In this process, learning happens when they perceive the inadequacies of their intuitive understandings - at least under certain conditions - and construct representations of the scientific concepts for them-

[2]We refrain from discussing the 'content' of objectual imagination because, to understate it, the 'exact character of the imagined content is up for dispute' (Meynell, 2014, p.4156). Many different frameworks for objectual imagination and further distinctions within objectual imagination are proposed; e.g., between imagistic and non-imagistic imagination—with little consensus in sight. Unfortunately, in-depth discussion is beyond the scope of this article. See, e.g., (Salis and Frigg, 2020, §1.4.1) for a brief discussion of various proposals.

> selves. (Nersessian, 2007, p.392)

As an example of this relation, Sam Rijken mentioned in his talk at the workshop how an early publication on scientific thought experiments by Kuhn (1964) discusses conceptual change in two analogous contexts. First, young children who were subjected to Piaget's famous experiments, and, second, Aristotelians who were confronted with Galilei's thought experiments as elaborated in *Dialogue*[3]. Interestingly for the present discussion, Kuhn explicitly used insights from the former to better understand the latter, thus presenting us with a rare case of education research influencing HPS in a context relevant for the concept of imagination:

> The historical context within which actual thought experiments assist in the reformulation or readjustment of existing concepts is inevitably extraordinarily complex. I therefore begin with a simpler, because nonhistorical, example, choosing for the purpose a conceptual transposition induced in the laboratory by the brilliant Swiss child psychologist Jean Piaget. (Kuhn, 1977, p.243).

Kuhn points towards a problem for the systematic study of imagination in the context of scientific discovery: historical contexts are extraordinarily complex. To add to this complexity, we would like to emphasise that historians and philosophers of science do not generally have epistemic access to the imagination as employed by scientists in the context of discovery[4]. It is therefore an important question—worthy of future research—whether students' cognitive development in science education may serve as a *proxy* for scientists' cognitive development in the context of discovery; specifically the cognitive development that results from the use of imagination, as is the case for scientific thought experimenting. We will return to this question at the end of this article.

2.2 Propositional imagination in HPS

The second branch of HPS literature on imagination concerns so-called *propositional* imagination. As opposed to objectual imagination, propositional imagination is usually not understood as a perception-like engagement with some imagined content but rather as an imaginative, non-veridical attitude towards *propositions*: an attitude that is belief-like (because it typically mirrors belief-like inference patterns) but not quite belief (for multiple reasons, e.g., that imagination is voluntary, does not necessarily aim at truth, and does not directly guide real-world action)[5]. One example of propositional imagination that is currently remarkably popular in the HPS literature is *make-believe*.

'Make-believe' is a theoretical notion from Walton's (1990) conceptual framework for systematic acts of imagination that are prompted and constrained by the presence of material objects. Walton called these systematic acts of imagination *games of make-believe*. He originally formulated his framework to account for acts of imagination stimulated by representational art and works of literary fiction. Material objects constrain the ima-

[3] Kuhn restricts his discussion to 'an intermediate group [of children], old enough to learn something from the experiments and young enough so that its responses were not yet those of an adult.' (Kuhn, 1964, p.243).

[4] Only since very recently is the imagination being studied 'in the lab' (Stuart, 2019). Interestingly, Stuart notes that the 'idea of studying imagination using empirical methods' has been acted upon in recent science education research, see (Stuart, 2019, p.3) for references.

[5] For elaboration on the relation between scientific imagination (specifically, pretense) and belief, see, e.g., (Gendler, 2010, Ch.7; Salis and Frigg, 2020; Özgön and Schoonen, Forthcoming).

gination of participants of such games of make-believe due to the imposition of specific rules that determine what to imagine next: the *principles of generation*. Because these principles of generation include relevant background knowledge and social conventions, the imaginative content of a specific game of make-believe can be agreed upon inter-subjectively. Games of make-believe are, therefore, explicitly *social* acts of imagination. This social aspect of the scientific imagination has previously not been discussed much in HPS literature because the imagination is, in general, typically construed as a feature of individual cognition.

The principles of generation are a crucial component of games of make-believe: they enable communicating about imaginary content by fixing that content inter-subjectively. Nevertheless, it is far from clear what exactly all the relevant principles of generation are in a specific game, or even whether all relevant principles can always be formulated clearly. Much insight on this matter can be found by studying how children develop the capacity for make-believe. Remarkably, even very young children can engage in 'complex coordinated games of joint pretense with others. And well before the age of 4, they have figured out how to keep track of different individuals simultaneously engaging in different games of pretense […] [and they] are extremely flexible and adaptive about the principles of generation we use when we engage in exercises of prop-based pretense' (Gendler, 2010, Ch.7). Presumably, research that looks at students and how they employ principles of generation in their imaginative acts —which in turn may bring about conceptual change— can provide bridging cases between games of make-believe played by young children and scientists.

Walton's games of make-believe and the construal of scientific imagination as make-believe have taken centre stage in HPS literature on scientific modelling in the past decade; e.g., (Frigg & Nguyen, 2020; Levy & Godfrey-Smith, 2020; Cassini & Redmond, 2021). Here, an important move has been to regard *model descriptions* as performing a significantly similar function as works of literary fiction do: model descriptions prescribe imaginings about some (imaginary) model system. The principles of generation play a significant role in determining the content of a scientific model, so this body of literature will most certainly benefit from an increased understanding of which principles of generation are involved in which games of make-believe - which science education research may provide. The notion of make-believe is also employed to account for the content of scientific thought experiments, and it is straightforwardly applicable to related topics concerning scientific imagination (c.f. Meynell, 2014; 2021). We believe, moreover, that the rise of make-believe in HPS is a promising development because make-believe's social aspect coheres well with a similar recent development on the notion of imagination in science education research.

2.3 Imagination in science education research

In parallel to developments in HPS, science education researchers have put increasing emphasis on the role of imagination in learning and doing science (e.g. Hadzigeorgiou, 2016; Kind & Kind, 2007; Steier & Kersting, 2019). Thought experiments, when presented correctly, are a powerful example of a pedagogical tool that invites the use of imagination. While thought experiments can serve as a stand-in for physical experiments that are too difficult or impossible to realise in the classroom, their true potential lies in connecting students' everyday experiences to implicit assumptions and abstract concepts. For this reason,

thought experiments have proven to be a fruitful instructional tool in learning domains that deal with abstract and counterintuitive concepts, such as quantum mechanics and relativity (Velentzas & Halkia, 2012).

Although it seems clear that imagining constitutes an essential activity in science education practices, research still lacks a clear understanding of how students incorporate imagining into their classroom processes. Since classroom settings are socially active environments, it makes sense to consider imagining as a form of action—instead of a static feature of individual cognition (Hilppö et al., 2016; Murphy, 2004). A sociocultural stance to imagining allows researchers to study patterns of classroom participation as students engage in imaginative activities. For example, students may draw on words, gestures, material representations or other forms of publicly available signs when performing imaginative activities (Steier et al., 2019). From this perspective, science education researchers can treat imagining as one form of representation practices (Greeno & Hall, 1997). While such a sociocultural stance does not argue against the mental modelling often linked with imagination in the HPS literature, it does shift the focus to signs that teachers can recognise and build on to facilitate science learning.

Approaching scientific imagination from a sociocultural perspective has its roots in the work of developmental psychologist Lev Vygotsky (1998, 2004). Vygotsky proposed that imagination is an internalisation of play. When children play, they develop the ability to combine impressions and experiences from the world around them into something new that is not physically present - or might not even exist in the real world. Through play, children also adopt norms and rules of their society which feed into their imagination. In this context, Vygotsky understood imagination as the ability to think about the possible and not just the actual.

As children get older, their imagination matures and develops into a tool for meaningful creative action (Hadzigeorgiou, 2016; Vygotsky, 2004). Instead of merely dreaming or playing, students may use their knowledge and previous experiences to create something new and meaningful:

> (…) imagination is as necessary in geometry as it is in poetry. Everything that requires artistic transformation of reality, everything that is connected with interpretation and construction of something new, requires the indispensable participation of imagination (Vygotsky, 1998, p. 153).

There is a promising continuity between Vygotsky's approach to imagination from a sociocultural perspective and Walton's approach to imagination as a social act of make-believe, specifically in the emphasis on the rules and patterns that govern imaginative acts. This continuity has been somewhat explored recently in science education research (e.g., Reznitskaya & Gregory, 2013; Maynard, 2019), but interaction with recent developments of Waltonian approaches to the imagination in HPS is absent, yet clearly desirable. Here, contemporary science education research can inform HPS research by providing insights into the rules that govern acts of imagination gained through classroom studies.

Question 3: Looking forward

Finally, let us address the third question: what is required to make the respective insights from HPS and science education research into conceptual

change of mutual benefit? In this article, we have examined how our joint engagement with conceptual change has led us to the topic of scientific imagination, and we have presented recent developments on scientific imagination in HPS and science education research. *To make these respective developments of mutual benefit, we now turn to two promising opportunities for fruitful interaction*. More generally, we argue that we need to move beyond the general theme of conceptual change and focus on specific topics, such as scientific imagination, and specific questions, such as the role of generation principles in imaginative interactions in science classrooms. Arguably, these topics and questions can only be answered comprehensively when HPS scholars and science education researchers combine their methods and insights.

The first opportunity for fruitful interaction is to explore the relation between the use of imagination in the scientist's context of discovery and the student's context of learning science. As mentioned in this article, these contexts have often been analysed in parallel, mainly for the purpose of applying newfound insights into the former to better understand the latter. However, given that imagination in the science classroom is now actively being studied, the question arises to what extent we may invert this flow of information. Can we study the scientific omi-imagination in the student's context of learning as a proxy for the scientist's context of discovery? We have indicated how HPS and science education research may find a common purpose and a shared terminology in Nersessian's account of conceptual change and her thoroughly developed notion of mental modelling. However, recent developments in HPS provide an alternative terminological framework that seems equally promising for this purpose.

The second opportunity for fruitful interaction centres on the concept of make-believe, a relatively new concept in HPS adapted from Walton's *games of make-believe* (1990). Games of make-believe are explicitly social acts of imagination. The fact that make-believe is currently taking centre stage in the HPS literature on imagination coheres well with the developments in science education research that stresses the importance of the socially active environment in which science students perform imaginative acts and communicate their understandings (Steier et al. 2019). We indicated the encouraging continuity between Vygotskyan approaches to the imagination in science education research and Waltonian games of make-believe in HPS, specifically in their focus on the rules that govern our acts of imagination in science research and education. Here, HPS and science education research may again find a common purpose and shared terminology that can further stimulate progress in both fields.

Finally, the question arises whether and how these two distinct possibilities for interaction between HPS and science education research can be realised. At this point, we do not wish to argue for specific ways in which this ought to be done. Instead, we invite colleagues to envision potential collaborations between HPS and science education that take their point of departure in shared questions and on the basis of knowledge gaps in both fields. We believe that progress will be achieved best if there is a shared vocabulary and focal point of research in the two disciplines, which, we have argued, can be found in contemporary approaches to the scientific imagination.

Conclusion

This workshop has shown that interactions between HPS and science education researchers can provide a good impetus for future research with mutual benefit. Having taken the topic of conceptual change as our joint starting point, we identified scientific imagination as a critical contemporary concept in both disciplines. To repeat, HPS has informed science education research quite a bit over the last few decades. We insist that this asymmetric relationship between the two disciplines limits progress on both sides. Therefore, we encourage scholars to investigate new ways in which field studies from 'within the classroom' may be informative for HPS. We believe that the scientific imagination is a contemporary concept that has great potential to stimulate fruitful interdisciplinary interactions in research on conceptual change and beyond.

Acknowledgements

We thank the other workshop speakers for their valuable contributions: Stella Vosniadou, Paul Hoyningen-Huene, Floor Kamphorst, Stefaan Blancke, Robert Meunier and Stig Børsen Hansen. We also thank the workshop participants for their lively engagement in the plenary discussions.

References

Cassini, A., & Redmond, J. Eds. (2021). *Models and Idealisations in Science: Artifactual and Fictional Approaches*. Springer, Cham.

Frigg, R., & Nguyen, J. (2020). *Modelling Nature: An Opinionated Introduction To Scientific Representation*. Springer, Cham.

Gendler, T. (2004). Thought Experiments Rethought— and Reperceived. *Philosophy of Science*, 71: 1152–1164.

Gendler, T. (2010). *Intuition, Imagination, and Philosophical Methodology*. Oxford: Oxford University Press, 2010.

Greeno, J. G., & Hall, R. P. (1997). Practicing Representation: Learning with and about representational forms. *Phi Delta Kappan*, 78(5), 361–367.

Hadzigeorgiou, Y. (2016). *Imaginative Science Education—The Central Role of Imagination in Science Education*. Springer International Publishing Switzerland.

Hilppö, J., Rajala, A., Zittoun, T., Kumpulainen, K., & Lipponen, L. (2016). Interactive dynamics of collective imagination in a science classroom. *Frontline Learning Research*, 4(4), 20–29.

Jackson, M.B. (2016). On the Epistemic Value of Imagining, Supposing, and Conceivings. In A. Kind and P. Kung, Eds. *Knowledge Through Imagination*, 41–60. Oxford: Oxford University Press.

Kamphorst, F., Vollebregt, M.J., Savelsbergh, E.R., van Joolingen, W.R. (2021) An educational reconstruction of special relativity theory for secondary education.*Science & Education*, 1–44.

Kind, P. M., & Kind, V. (2007). Creativity in Science Education: Perspectives and Challenges for Developing School Science. *Studies in Science Education*, 43(1), 1–37. doi:10.1080/03057260708560225

Kuhn, T.S. (1964). A Function for Thought Experiments. Reprinted in T. Kuhn. (1977). *The Essential Tension*. Chicago: University of Chicago Press, 240–265.

Levy, A., & Godfrey-Smith, P. Eds. (2020). *The Scientific Imagination: Philosophical and Psychological Perspectives*. Oxford: Oxford University Press.

Maynard, P. (2019). Rules: a Toy Box. *Phenomenology and Mind* 17, 94-111.

Murphy, K. M. (2004). Imagination as joint activity: The case of architectural interaction. *Mind, Culture, and Activity*, 11(4), 267–278.

Meynell, L. (2014). Imagination and insight: a new account of the content of thought experiments. *Synthese*, 191(17): 4149–4168, 2014.

Meynell, L. (2021). Review of *The Scientific Imagination*, Levy, A. and Godfrey-Smith, P. Eds. *Mind*.

Nersessian, N. J. (1992). How do scientists think? Capturing the dynamics of conceptual change in science. In Giere, R.N., Ed. *Cognitive Models of Science*. Minneapolis, MN: University of Minnesota Press, 3-45.

Nersessian, N. J. (1998). Conceptual change. In Bechtel, W. & Graham, G. Eds. *A Companion to Cognitive Science*. Malden, MA: Blackwell, 155-166.

Nersessian, N. J. (2007). Mental Modeling in Conceptual Change. *International Handbook of Conceptual Change*, S. Vosniadou, ed. (London: Routledge, 2008, 391-416)

Nersessian, N.J. (2008). *Creating Scientific Concepts*. Cambridge, MA: MIT Press.

Özgön, A., & Schoonen, T. (Forthcoming). Logical development of pretense imagination. *Erkenntnis*.

Reznitskaya, A. & Gregory, M. (2013). Student Thought and Classroom Language: Examining the Mechanisms of Change in Dialogic Teaching. *Educational Psychologist*, 48(2), 114-133.

Russell, B. (1925). *ABC of Relativity* (Kegan-Paul, Trench, & Trubner, Eds.). Allen & Unwin.

Salis, F., & Frigg, R. (2020). Capturing the Scientific Imagination. In A. Levy and P. Godfrey-Smith, Eds., *The Scientific Imagination*, 17–50. Oxford: Oxford University Press.

Steier, R., & Kersting, M. (2019). Metaimagining and embodied conceptions of spacetime. *Cognition and Instruction*, 37(2), 145–168.

Steier, R., Kersting, M., & Silseth, K. (2019). Imagining with improvised representations in CSCL environments. *International Journal of Computer-Supported Collaborative Learning*, 14(1), 109–136.

Stuart, M.T. (2019). Everyday Scientific Imagination: A Qualitative Study of the Uses, Norms, and Pedagogy of Imagination in Science. *Science & Education* 28, 711-730.

Velentzas, A., & Halkia, K. (2013), The use of thought experiments in teaching physics to upper secondary-level students: Two examples from the theory of relativity, *International Journal of Science Education*. 35, 3026.

von Aufschnaiter, C., & Rogge, C. (2015). Conceptual Change in Learning. In G. R. (Ed.), *Encyclopedia of Science Education*. Springer. doi:10.1007/978-94-007-2150-0

Vosniadou, S. (Ed.). (2008). *International Handbook of Research on Conceptual Change* (1st ed.). Routledge. doi:10.4324/9780203874813

Vygotsky, L. (1998). *The Collected Works of L. S. Vygotsky* (R.W. Rieber & A.S. Carton, Red.; 5. utg.). Springer.

Vygotsky, L. (2004). Imagination and creativity in childhood. *Journal of Russian and East European Psychology*, 42(1), 7–97.

Walton, K.L. (1990). *Mimesis as Make-Believe: On the Foundations of the Representational Arts*. Cambridge, MA: Harvard University Press.

Invitation to Submit Opinion Piece

In order to make better educational use of the wide geographical and disciplinary reach of this HPS&ST NEWSLETTER, invitations are extended for readers to contribute opinion or position pieces or suggestions about any aspect of the past, present or future of HPS&ST studies.

Contributions can be sent direct to Michael Matthews or Nathan Oseroff-Spicer.

Ideally, they might be pieces that are already on the web, in which case a few paragraphs introduction, with link to web site can be sent, or else the pieces will be put on the web with a link given in the NEWSLETTER.

They will be archived in the OPINION folder at the HPS&ST web site: http://www.hpsst.com/.

PhD Theses in HPS&ST Domain

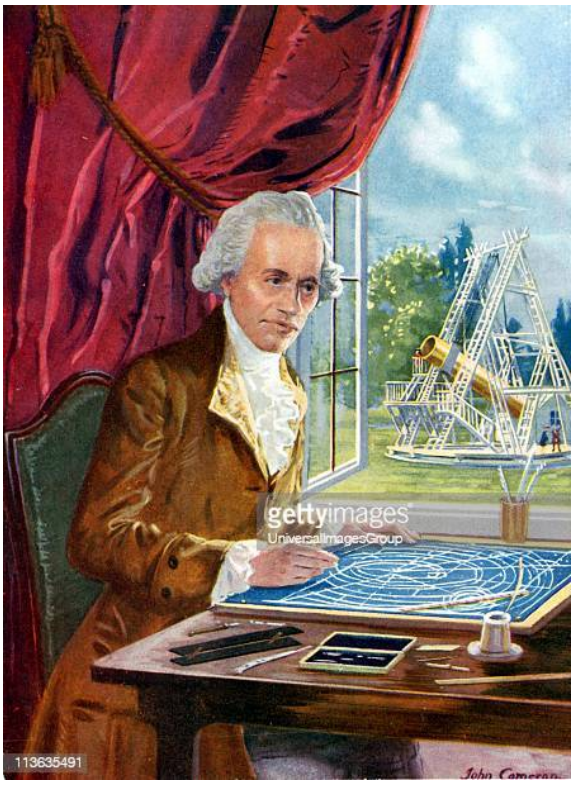
The HPS&ST NEWSLETTER is the ideal medium for publicising and making known submitted and awarded doctoral theses in the HPS&ST domain.

The following details should be submitted to the editor at m.matthews@unsw.edu.au:

- Candidate's name and email
- Institution
- Supervisor
- Thesis title
- Abstract of 100-300 words
- Web link when theses are required to be submitted for open search on web.

'Cosmic Harmonies': A Symposium Celebrating the Life, Science, Music, and Legacy of William Herschel (1738-1822), University of York (UK), 19 June 2022

2022 sees the two-hundredth anniversary of the death of William Herschel, a profoundly significant figure in the field of astronomy, but one who made his early living as a musician - as an oboist, violinist, harpsichordist, organist, composer, and impresario.



After leaving a military band in his native Hanover for an unsuccessful two-year stint in London (1757-59), Herschel moved to the north of England (1760), where he composed his symphonies and many other works as an itinerant musician in Richmond, Newcastle, Sunderland, Durham, Pontefract, Doncaster, Leeds, and Halifax. In 1766 he accepted an invitation as organist at the new Octagon Chapel in Bath, where he became a mainstay of the musical scene for over fifteen years. In Bath he was joined by other musical family members including his sister Caroline, who assisted William first in musical and then in astronomical duties, ultimately becoming a distinguished astronomer in her own right.

Herschel's astronomical interests and construction of very high-quality telescopes, beginning in 1773, brought him to international and lasting fame when he discovered the planet now called Uranus in 1781. He came to the attention of King George III, who summoned him to Windsor and effectively ended the musical portion of his career, at age 43. For the rest of his life Herschel made numerous ground-breaking contributions: designing large telescopes; mapping the Milky Way system of stars and the Sun's motion in it; cataloguing and classifying thousands of star clusters, nebulae, variable stars, and double stars; proving the effectiveness of gravity outside the solar system; discovering several moons around Saturn and Uranus; discovering infrared radiation (from the Sun); postulating an evolving universe with stars and nebulae that are born, age, and die; estimating the age of the Universe; and arguing that all stars and planets are populated with intelligent beings.

Contemporary academia's separation of music and astronomy across the arts and sciences is something Herschel and other eighteenth-century thinkers would have found hard to understand, given both endeavours proceeded for them on mathematical principles. This symposium takes the bicentenary of his death as a cue to explore new aspects of Herschel's work as composer, instrumentalist, impresario, and astronomer in the intellectual, creative, and cultural contexts of his time. Our symposium will take a wide perspective on astronomy, music, and natural philosophy, including both the Herschels' legacy in science and art today.

Proposals of no more than 200 words should be sent to Rachel Cowgill University of York by **11 February 2022** with the title 'Herschel Bicentenary Symposium proposal', and should include the author's/co-authors' name, affiliation, and email address.

The symposium will conclude with a public keynote lecture by Professor Tom McLeish FRS (University of York), a panel discussion on Herschel's legacies, and a concert of Herschel's music given

as part of the York Festival of Ideas, 11-24 June 2022. We are grateful for the support of the Festival in organising these bicentenary events. Further activities celebrating the ways science and music interconnect are planned for 2022, organised by the University of York's Sound, Voices, and Technology research network (SoVoT).

Varia

- **Fourth International Conference of the German Society for Philosophy of Science**

  The Fourth International Conference of the German Society for Philosophy of Science (GWP.2022), which was originally scheduled for March 2022, will **now take place from 15th-17th of August 2022**, at Technische Universität Berlin. The line-up of talks and contributed papers/symposia remains unchanged (no new CfP will be necessary). For more information, see https://www.wissphil.de/gwp2022/

- **The Konrad Lorenz Institute for Evolution and Cognition Research** (KLI) in Klosterneuburg (Austria) announces 5 Writing-Up Fellowships for late-stage PhD students working on topics related to 'Cognition and Knowledge: Between Evolution and Sustainability.' With this call, the KLI aims to support an interdisciplinary cohort of 5 late-stage PhD students whose works use novel interdisciplinary approaches in the study of cognition and knowledge, especially in relation to evolution and to their connection to sustainability. Learn more about application and deadlines here, and from Dr. Lynn Chiu here.

PhD Award in HPS&ST Floor Koeleman

- Candidate's name and email
  Dr. Floor Koeleman
  Floor.Koeleman@unil.ch
- Institution
  University of Luxembourg, Centre for Contemporary and Digital History & Institute for History
  Currently: University of Lausanne
- Supervisor
  Prof. Dr. Martin Uhrmacher
- Thesis title
  Visualizing Visions: Re-viewing the seventeenth-century genre of constcamer paintings
- Abstract

  Constcamer paintings or pictures of collections were created almost exclusively in Antwerp, and to a lesser extent in Brussels, in the seventeenth century. Until now, no attempt had been made to collect all known examples, partly because of the contemporary distribution of such works across collections throughout the Western world. Another difficulty in studying constcamer paintings is the great complexity of the rich variety of subjects, objects, and concepts on display in the images that combine many disciplines separated today.

  Advances in the field of computer science have made it possible to systematically collect, archive, and analyze artworks and associated information on a large scale. My digital approach to the genre aimed to determine what a constcamer painting is, in terms of form, content, and meaning. In addition to looking at pictorial features and cognitively identifying what we

see, contextualization played a key role in achieving understanding.

Pictorial, historical, social, cultural, and intellectual contexts served as the framework for interpretation. Special attention has been paid to the interplays between collecting and recollecting, art and science, and physical and metaphysical vision.

This thesis argues that pictures of collections primarily lay claim to the active intellect to generate insights by uncovering the multitude of meanings embedded in the seventeenth-century genre. The examination of constcamer paintings through a dataset led to enhanced perception and highlighted the prominence of visuality in the transmission and acquisition of knowledge, both then and now.

• Web link when theses are required to be submitted for open search on web.
http://hdl.handle.net/10993/48720

For more information, please contact direct:
Floor Koeleman, floorkoeleman@gmail.com

We welcome publishing details of all PhDs awarded in the field of HPS&ST Do send details (as above) to editor: m.matthews@unsw.edu.au

Vale: Michael Hoskin (1930–2021)

Michael Hoskin, the highly distinguished historian of astronomy and biographer of the Herschel family, died peacefully at his home in Cambridge on 5 December 2021. Michael was born in London on 27 February 1930, the only child of a tax collector and a schoolteacher. He attended a Catholic grammar school in west London, and recalled surviving the bombing blitz of 1940, then the V1 flying bombs, and finally the V2 rockets. At the University of London, he earned a BA and an MA in pure mathematics. He commenced his doctorate in algebraic geometry at Peterhouse, Cambridge in 1952, on completion of which he was elected to a Research Fellowship at Jesus College in 1956. In the same year he married Jean (Jane) Margaret Small, with whom he had five children.

Michael Hoskin speaking at Antequera on his acceptance of the Royal Gold Medal from Filipe VI of Spain. Image Jon Hoskin

Michael soon found the dazzling brilliance of another mathematician, Michael Atiyah (1929–2019) unnerving, which was hardly surprising: Atiyah became one the greatest British mathematicians since Isaac Newton. By 1958 Hoskin was searching for a different field of scholarship offering what he described as "fun". By chance he noticed an advertisement for a newly established lectureship in the history of science at the University of Leicester. Although the other applicants had doctorates

in the history of science, Hoskin's postdoctoral research fellowship made him the candidate with the most promise. A similar lectureship at Cambridge became vacant two years later. Hoskin, the outstanding applicant, was appointed without a formal interview. And so began his career of more than fifty years of fun as a historian of mathematics and astronomy.

Initially Hoskin's teaching responsibilities covered the whole of the history of science. He became the doctoral supervisor of D. T. (Tom) Whiteside (1932–2008), with whom he would eventually edit The Mathematical Papers of Isaac Newton, a monumental enterprise encompassing eight volumes, published by Cambridge University Press. Michael felt that his work on Newton's cosmology was his most important lifetime contribution.

When Michael's career as a historian of science began the discipline in the UK was a very small field, dominated by scientists, who judged the past in terms of the present. By contrast, Michael invariably commanded his students that their essays must be correctly located in the context of the past. When appraising an essay or dissertation he would have his rubber stamp "so what?" to hand, banging red ink onto the margins of work that had failed to convince him. And woe betide any doctoral candidates who dared to copy sources they had not scrutinised personally!

Michael Hoskin was the world's leading authority on the Herschel family of astronomers, on whose lives and works he wrote eight books and three dozen papers. His corpus elegantly documents the extraordinary devotion and commitment of William and his sister Caroline to observing the universe. William surely holds world record for the amount of time spent observing and recording the deeper cosmos. Michael was a storyteller of science par excellence who interwove discovery, local colour, and personal challenges, to create a vivid tapestry of the remarkable lives and achievements of the Herschels of Hanover.

Hoskin's Discoverers of the Universe: William and Caroline Herschel, published in 2011 when he was in his early eighties, is a full biography, crammed with colour, detail and passion. Hoskin sets the scene with two penniless Hanoverian refugees from the ravages of the Seven Years' War, William and his brother Jacob, surviving two years in London by scraping a precarious living as musicians – copying, teaching and performing. From that unpromising start in Britain, William ascended to the rank of Royal Astronomer to George III. Meanwhile his assistant Caroline became the first female astronomer in history to be awarded a life pension. Reviewers heaped praise on Discoverers: "Hoskin has forever fixed the Herschels in the firmament", and "A very highly readable account of the Golden Age of British astronomy".

After a London publisher asked Hoskin if there were areas of the history of science being neglected by the literature, he suggested launching the Journal for the History of Astronomy (JHA). Michael edited and contributed to JHA for the next 45 years. The journal continues Michael's foundational mission by covering the history of astronomy from the earliest times to the present day, including its cultural aspects and, by extension, the history of the relevant branches of mathematics and physics.

The early years of JHA coincided with a period of intense interest in the possibility that a true science of astronomy had existed in Britain in prehistoric times. The leading figure in this movement was Alexander Thom (1894–1985), a retired professor of engineering science at the

University of Oxford, who became an expert at measuring megalithic stone circles. However, Thom was not good at arguing a case, and so a partnership developed in which some twenty papers by Thom were published in the JHA, which Michael would claim (with a grin) "were ghost-written by Hoskin."

In retirement Michael undertook two decades of demanding fieldwork on some 3000 neolithic tombs, temples and dolmens in France and Iberia. He was surprised to find the profusion of tombs that faced the rising Sun. At Antequera in southern Spain, his research on three enormous dolmens had a momentous consequence when he supported the local authorities in a successful application for World Heritage Status. For his decisive contribution he received the Gold Medal of the Kingdom of Spain from the hands of the sovereign. Today at Antequera one can admire the Mirador Michael Hoskin, together with a bust and plaque recording the gratitude of the City, and the Archaeological Museum that bears his name.

Michael Hoskin was a wonderfully warm and cheerful colleague, ever willing to share time and conversation with students, faculty and indeed anyone with an interest in the long history of astronomy. His many contributions to the field will surely be his enduring legacy.

Simon Mitton, Cambridge. 17 January 2022

Recent HPS&ST Research Articles

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Almeida, B., Santos, M. & Justi, R. (2022). Aspects and Abilities of Science Literacy in the Context of Nature of Science Teaching. *Sci & Educ*, 1-21. doi:10.1007/s11191-022-00324-4 online first

Bennion, A., Davis, E.A. & Palincsar, A.S. (2022). Novice elementary teachers' knowledge of, beliefs about, and planning for the science practices: a longitudinal study. *International Journal of Science Education*, doi:10.1080/09500693.2021.2021311 online first

Bloor, T., Santini, J. (2022). Modeling the Epistemic Value of Classroom Practice in the Investigation of Effective Learning. *Sci & Educ*, 1-29. Online first doi:10.1007/s11191-021-00298-9 online first

Burton, E. (2022). Comparative globalizations: Building and dismantling genetic laboratories in Lebanon. *The British Journal for the History of Science*, 1-19. doi:10.1017/S0007087421000820 online first

Caramaschi, M., Cullinane, A., Levrini, O. & Erduran, S. (2021) Mapping the nature of science in the Italian physics curriculum: from missing links to opportunities for reform, *International Journal of Science Education*, doi:10.1080/09500693.2021.2017061 online first

Cardinot, D., Moura, C. & Guerra, A. (2022). Challenging the "Science from nowhere" perspective in the classroom: Action research about a historical case of Brazilian science. *Sci & Educ*, 1-33. doi:10.1007/s11191-021-00311-1 online first

Cobern, W.W., Adams, B.A., Pleasants, B.AS. et al. (2022). Do We Have a Trust Problem? Exploring Undergraduate Student Views on the Tentativeness and Trustworthiness of Science.

Sci & Educ, 1-30.
doi:10.1007/s11191-021-00292-1 online first

Covitt, B.A., Anderson, C.W. (2022). Untangling Trustworthiness and Uncertainty in Science: Implications for Science Education. *Sci & Educ*, 1-26.
doi:10.1007/s11191-022-00322-6

de Carvalho Ferrasa, I.A., Machado, E.F., Miquelin, A.F. et al. (2022). Mary Shelley's Frankenstein: Dialogs Between Fiction and Science Teaching. *Sci & Educ*, 1-22. doi:10.1007/s11191-021-00309-9 online first

Dei, L. (2022). Creativity in the art, literature, music, science, and inventions. *Substantia. An International Journal of the History of Chemistry*, 1-19. doi:10.36253/Substantia-1524 online first

Dudas, C., Rundgren, CJ. & Lundegård, I. (2022). Exploratory Considerations in Chemistry Education—Didactic Modelling for Complexity in Students' Discussions. *Sci & Educ*, 1-18. doi:10.1007/s11191-021-00316-w online first

Eilam, E. (2022) Climate change education: the problem with walking away from disciplines, *Studies in Science Education*, 1-35. doi:10.1080/03057267.2021.2011589 online first

Ferguson, S.L. (2022). Teaching What Is "Real" About Science: Critical Realism as a Framework for Science Education. *Sci & Educ*, 1-19. doi:10.1007/s11191-021-00308-w online first

Karaman, A. (2022). Teachers' Conceptions About Science and Pseudoscience: Distinguishing Astronomy from Astrology. *Sci & Educ*, 1-30. doi:10.1007/s11191-021-00312-0 online first

Klopfer, L. E., & Aikenhead, G. S. (2022). Humanistic science education: The history of science and other relevant contexts. *Science Education*, 1– 15. doi:10.1002/sce.21700

Herman, B.C., Clough, M.P. & Rao, A. (2022). Socioscientific Issues Thinking and Action in the Midst of Science-in-the-Making. *Sci & Educ*, 1-35. doi:10.1007/s11191-021-00306-y online first

Lima, N.W. (2022). Michael Matthews and the development of History, Philosophy and Science Teaching: thirty years after 'the present rapprochement'. *Review of Science, Mathematics and ICT Education*, 15(2),101-121.
doi:10.26220/rev.3824

Lima, N.W., Nascimento, M.M. (2022). Not Only Why but Also How to Trust Science: Reshaping Science Education Based on Science Studies for a Better Post-pandemic World. *Sci & Educ*, 1-20. doi:10.1007/s11191-021-00303-1 online first

Lin, L., Song, Q., Wang, J. et al. (2022). History of Science in Two Recent Versions of High School Physics Textbooks in China. *Sci & Educ*, 1-21. doi:10.1007/s11191-021-00307-x online first

Mattos, C., Lopez, F.S., Ortega, J.L. et al. (2022). The Public Discussion on Flat Earth Movement: An Analysis Based on the Esperantist-Epideictic Discourse. *Sci & Educ*, 1-23. doi:10.1007/s11191-022-00321-7 online first

Nemati, F. (2022). Anthropomorphism in the Context of Scientific Discovery: Implications for Comparative Cognition. *Found Sci*, 1-19. doi:10.1007/s10699-021-09821-1 online first

Piqueras, J., Achiam, M., Edvall, S. et al. (2022) Ethnicity and Gender in Museum Representations of Human Evolution: The Unquestioned and the Challenged in Learners' Meaning Making. *Sci & Educ*, 1-24.
doi:10.1007/s11191-021-00314-y

Rowland, J., Estevens, J., Krzewińska, A. et al. (2022). Trust and Mistrust in Sources of Scientific Information on Climate Change and Vaccines: Insights from Portugal and Poland. *Sci & Educ*, 1-26. doi:10.1007/s11191-021-00304-0

Schmechel, C. (2022). Descartes on fermentation in digestion: Iatromechanism, analogy and teleology. *The British Journal for the History of Science*, 1-16. doi:10.1017/S0007087421000819 online first.

Şeker, F., Aydinli, B. (2021). A Trial Patch to Sustainable Development: Perspectives from Extracurricular Activities of Elementary Schools in Turkey. *Sci & Educ*, 1-26. doi:10.1007/s11191-021-00315-x

Shaw, J. (2022). Revisiting the Basic/Applied Science Distinction: The Significance of Urgent Science for Science Funding Policy. *J Gen Philos Sci*, 1-23. doi:10.1007/s10838-021-09575-1

Tan, AL., Ong, Y.S., Ng, Y.S. et al. (2022). STEM Problem Solving: Inquiry, Concepts, and Reasoning. *Sci & Educ*, 1-17. doi:10.1007/s11191-021-00310-2 online first

Tang, K.-S. (2022). Material inquiry and transformation as prerequisite processes of scientific argumentation: Toward a social-material theory of argumentation. *Journal of Research in Science Teaching*, 1– 41. doi:10.1002/tea.21749 online first

van Putten, K. (2022). Three-Dimensional Phylogeny in Two Dimensions: How Darwin and Other Nineteenth-Century Naturalists Created Three-Dimensional Figures of the Natural System by Combining Trees of Life and Maps of Affinity. *J Hist Biol*, 1-49. doi:10.1007/s10739-021-09662-5 online first

Wu, JY., Erduran, S. (2022) Investigating Scientists' Views of the Family Resemblance Approach to Nature of Science in Science Education. *Sci & Educ*, 1-30. doi:10.1007/s11191-021-00313-z online first

Recent HPS&ST Related Books

Demopoulos, W. (2022). *On Theories: Logical Empiricism and the Methodology of Modern Physics*. (Ed. by Michael Friedman). Cambridge, MA: Harvard University Press.
ISBN: 978-0-674-23757-5

"The logical empiricist treatment of physics dominated twentieth-century philosophy of science. But the logical empiricist tradition, for all it accomplished, does not do justice to the way in which empirical evidence functions in modern physics.

"In his final work, the late philosopher of science William Demopoulos contends that philosophers have failed to provide an adequate epistemology of science because they have failed to appreciate the tightly woven character of theory and evidence. As a consequence, theory comes apart from evidence. This trouble is nowhere more evident than in theorising about particle and quantum physics. Arguing that we must consider actual experiments as they have unfolded across history, Demopoulos provides a new epistemology of theories and evidence, albeit one that stands on the shoulders of giants.

"On Theories finds clarity in Isaac Newton's suspicion of mere "hypotheses." Newton's methodology lies in the background of Jean Perrin's experimental investigations of molecular reality and of the subatomic investigations of J. J. Thomson and Robert Millikan. Demopoulos extends this account to offer novel insights into the distinctive nature of quantum reality, where a logico-mathematical reconstruction of Bohrian complementarity meets John Stewart Bell's empirical analysis of Einstein's "local realism." On

Theories ultimately provides a new interpretation of quantum probabilities as themselves objectively representing empirical reality." (From the Publisher)

More information available here.

Freire Jr, Olival et al. (Eds.) (2022). *The Oxford Handbook of the History of Quantum Interpretations*. Oxford, UK: Oxford University Press. ISBN: 978-0-198-84449-5

"Crucial to most research in physics, as well as leading to the development of inventions such as the transistor and the laser, quantum mechanics approaches its centenary with an impressive record. However, the field has also long been the subject of ongoing debates about the foundations and interpretation of the theory, referred to as the quantum controversy.

"This *Oxford Handbook* offers a historical overview of the contrasts which have been at the heart of quantum physics for the last 100 years. Drawing on the wide-ranging expertise of several contributors working across physics, history, and philosophy, the handbook outlines the main theories and interpretations of quantum physics. It goes on to tackle the key controversies surrounding the field, touching on issues such as determinism, realism, locality, classicality, information, measurements, mathematical foundations, and the links between quantum theory and gravity.

"This engaging introduction is an essential guide for all those interested in the history of scientific controversies and history of quantum physics. It also provides a fascinating examination of the potential of quantum physics to influence new discoveries and advances in fields such quantum information and computing." (From the Publisher)

More information available here.

Gillin, Edward J. (2022). *Sound Authorities: Scientific and Musical Knowledge in Nineteenth-Century Britain*. Chicago IL: Chicago University Press. ISBN: 978-0-226-78777-0

"In *Sound Authorities*, Edward J. Gillin focuses on hearing and aurality in Victorian Britain, claiming that the development of the natural sciences in this era cannot be understood without attending to the study of sound and music.

"During this time, scientific practitioners attempted to fashion themselves as authorities on sonorous phenomena, coming into conflict with traditional musical elites as well as religious bodies. Gillin pays attention to sound in both musical and nonmusical contexts, specifically the cacophony of British industrialisation. *Sound Authorities* begins with the place of acoustics in early nineteenth-century London, examining scientific exhibitions, lectures, spectacles, workshops, laboratories, and showrooms. He goes on to explore how mathematicians mobilised sound in their understanding of natural laws and their vision of a harmonious ordered universe. In closing, Gillin delves into the era's religious and metaphysical debates over the place of music (and humanity) in nature, the relationship between music and the divine, and the tensions between spiritualist understandings of sound and scientific ones." (From the Publisher)

More information available here.

Gleiser, M. (Ed.) (2022). *Great Minds Don't Think Alike: Debates on Consciousness, Reality, Intelligence, Faith, Time, AI, Immortality, and the Human*. Columbia, NY: Columbia University Press. ISBN: 978-0-231-20411-8

"Does technology change who we are, and if so, in what ways? Can humanity transcend physical bodies and spaces? Will AI and genetic engineering help us reach new heights or will

they unleash dystopias? How do we face mortality, our own and that of our warming planet? Questions like these—which are only growing more urgent—can be answered only by drawing on different kinds of knowledge and ways of knowing. They challenge us to bridge the divide between the sciences and the humanities and bring together perspectives that are too often kept apart.

"*Great Minds Don't Think Alike* presents conversations among leading scientists, philosophers, historians, and public intellectuals that exemplify openness to diverse viewpoints and the productive exchange of ideas. Pulitzer and Templeton Prize winners, MacArthur "genius" grant awardees, and other acclaimed writers and thinkers debate the big questions: who we are, the nature of reality, science and religion, consciousness and materialism, and the mysteries of time. In so doing, they also inquire into how uniting experts from different areas of study to consider these topics might help us address the existential risks we face today. Convened and moderated by the physicist and author Marcelo Gleiser, these public dialogues model constructive engagement between the sciences and the humanities—and show why intellectual cooperation is necessary to shape our collective future.

"Contributors include David Chalmers and Antonio Damasio; Sean Carroll and B. Alan Wallace; Patricia Churchland and Jill Tarter; Rebecca Goldstein and Alan Lightman; Jimena Canales and Paul Davies; Ed Boyden and Mark O'Connell; Elizabeth Kolbert and Siddhartha Mukherjee; Jeremy DeSilva, David Grinspoon, and Tasneem Zehra Husain." (From the Publisher)

More information available here.

Gordin, Michael D. (2022). *Einstein in Bohemia*. Cambridge, MA: Princeton University Press. ISBN: 978-0-691-20382-9 [New in Paperback]

"In the spring of 1911, Albert Einstein moved with his wife and two sons to Prague, the capital of Bohemia, where he accepted a post as a professor of theoretical physics. Though he intended to make Prague his home, he lived there for just sixteen months, an interlude that his biographies typically dismiss as a brief and inconsequential episode. *Einstein in Bohemia* is a spellbinding portrait of the city that touched Einstein's life in unexpected ways—and of the gifted young scientist who left his mark on the science, literature, and politics of Prague.

"Michael Gordin's narrative is a masterfully crafted account of a person encountering a particular place at a specific moment in time. Despite being heir to almost a millennium of history, Einstein's Prague was a relatively marginal city within the sprawling Austro-Hungarian Empire. Yet Prague, its history, and its multifaceted culture changed the trajectories of Einstein's personal and scientific life. It was here that his marriage unraveled, where he first began thinking seriously about his Jewish identity, and where he embarked on the project of general relativity. Prague was also where he formed lasting friendships with novelist Max Brod, Zionist intellectual Hugo Bergmann, physicist Philipp Frank, and other important figures.

"Einstein in Bohemia sheds light on this transformative period of Einstein's life and career, and brings vividly to life a beguiling city in the last years of the Austro-Hungarian Empire." (From the Publisher)

More information available here.

Gutas, D. (Ed.) (2022). *Why Translate Science? Documents from Antiquity to the 16th Century in the Historical West (Bactria to the Atlantic)*. London: Brill. ISBN: 978-9-004-47263-1

"From antiquity to the 16th century, translation united culturally the peoples in the historical West (from Bactria to the shores of the Atlantic) and fuelled the production and circulation of knowledge. The Hellenic scientific and philosophical curriculum was translated from and into, to mention the most prevalent languages, Greek, Syriac, Middle Persian, Arabic, Hebrew, and Latin. "To fill a lack in existing scholarship, this volume collects the documents that present the insider evidence provided in contemporary accounts of the motivations and purposes of translation given in the personal statements by the agents in this process, the translators, scholars, and historians of each society. Presented in the original languages with an English translation and introductory essays, these documents offer material for the study of the historical contextualisation of the translations, the social history of science and philosophy in their interplay with traditional beliefs, and the cultural policies and ideological underpinnings of these societies." (From the Publisher)

More information available here.

Holm, S., & Serban, M. (Eds.) (2022). *Philosophical Perspectives on the Engineering Approach in Biology: Living Machines?* London, UK: Routledge. ISBN: 978-0-367-49146-8

"*Philosophical Perspectives on the Engineering Approach in Biology* provides a philosophical examination of what has been called the most powerful metaphor in biology: The machine metaphor. The chapters collected in this volume discuss the idea that living systems can be understood through the lens of engineering methods and machine metaphors from both historical, theoretical, and practical perspectives.

"In their contributions the authors examine questions about scientific explanation and methodology, the interrelationship between science and engineering, and the impact that the use of engineering metaphors in science may have for bioethics and science communication, such as the worry that its wide application reinforces public misconceptions of the nature of new biotechnology and biological life. The book also contains an introduction that describes the rise of the machine analogy and the many ways in which it plays a central role in fundamental debates about e.g. design, adaptation, and reductionism in the philosophy of biology.

"The book will be useful as a core reading for professionals as well as graduate and undergraduate students in courses of philosophy of science and for life scientists taking courses in philosophy of science and bioethics."

More information available here.

McDonough, Jeffrey K. (2022). *A Miracle Creed: The Principle of Optimality in Leibniz's Physics and Philosophy*. Oxford, UK: Oxford University Press. ISBN: 978-0-197-62907-9

"A rival to Isaac Newton in mathematics and physics, Gottfried Wilhelm Leibniz believed that our world—the best of all possible worlds—must be governed by a principle of optimality. This book explores Leibniz's pursuit of optimality in five of his most important works in natural philosophy and shows how his principle of optimality bridges his scientific and philosophical studies. The first chapter explores Leibniz's work on the laws of optics and its implications for his defence of natural teleology. The second chapter examines Leibniz's work on the breaking strength of rigid beams and its implications for his thinking about the metaphysical foundations of the material world. The third chapter revisits Leibniz's famous defence of the conservation of vis viva and proposes a novel account of the origin of Leibniz's mature natural philosophy. The fourth chapter takes up Leibniz's ef-

forts to determine the shape of freely hanging chains—the so-called problem of the catenary—and shows how that work provides an illuminating model for his thinking about the teleological structure of wills. Finally, the fifth chapter uses Leibniz's derivation of the path of quickest descent—his solution to the so-called problem of the Brachistochrone—and its historical context as a springboard for an exploration of the legacy of Leibniz's physics. The book closes with a brief discussion of the systematicity of Leibniz's thinking in philosophy and the natural sciences." (From the Publisher)

More information available here.

McLeish, Tom (2022). *The Poetry and Music of Science: Comparing Creativity in Science and Art*. Oxford, UK: Oxford University Press. ISBN: 978-0-192-84537-5 [New in Paperback]

"What human qualities are needed to make scientific discoveries, and which to make great art? Many would point to 'imagination' and 'creativity' in the second case but not the first. This book challenges the assumption that doing science is in any sense less creative than art, music or fictional writing and poetry, and treads a historical and contemporary path through common territories of the creative process. The methodological process called the 'scientific method' tells us how to test ideas when we have had them, but not how to arrive at hypotheses in the first place. Hearing the stories that scientists and artists tell about their projects reveals commonalities: the desire for a goal, the experience of frustration and failure, the incubation of the problem, moments of sudden insight, and the experience of the beautiful or sublime.

"Selected themes weave the practice of science and art together: visual thinking and metaphor, the transcendence of music and mathematics, the contemporary rise of the English novel and experimental science, and the role of aesthetics and desire in the creative process. Artists and scientists make salient comparisons: Defoe and Boyle; Emmerson and Humboldt, Monet and Einstein, Schumann and Hadamard. The book draws on medieval philosophy at many points as the product of the last age that spent time in inner contemplation of the mystery of how something is mentally brought out from nothing. Taking the phenomenon of the rainbow as an example, the principles of creativity within constraint point to the scientific imagination as a parallel of poetry." (From the Publisher)

More information available here.

Misa, Thomas J. (2022). *Leonardo to the Internet: Technology and Culture from the Renaissance to the Present (3rd Edition)*. Baltimore, MD: Johns Hopkins University Press. ISBN: 978-1-421-40153-9

"Historian Thomas J. Misa's sweeping history of the relationship between technology and society over the past 500 years reveals how technological innovations have shaped—and have been shaped by—the cultures in which they arose. Spanning the preindustrial past, the age of scientific, political, and industrial revolutions, as well as the more recent eras of imperialism, modernism, and global security, this compelling work evaluates what Misa calls "the question of technology."

"In this edition, Misa brings his acclaimed text up to date by drawing on current scholarship while retaining sharply drawn portraits of individual people, artefacts, and systems. Each chapter has been honed to relate to contemporary concerns. Globalisation, Misa argues, looks differently considering today's virulent nationalism, cultural chauvinism, and trade wars. A new chapter focuses on the digital age from 1990 to 2016. The book also examines how today's

unsustainable energy systems, insecure information networks, and vulnerable global shipping have helped foster geopolitical risks and instability and takes a look at the coronavirus pandemic from the perspective of Wuhan, China's high-tech district.

"A masterful analysis of how technology and culture have influenced each other over five centuries, Leonardo to the Internet frames a history that illuminates modern-day problems and prospects faced by our technology-dependent world." (From the Publisher)

More information available here.

Nadler, S, & Shapiro, L. (2021). *When Bad Thinking Happens to Good People: How Philosophy Can Save Us from Ourselves*. Princeton, NJ: Princeton University Press.
ISBN: 978-0-691-21276-0

"There is an epidemic of bad thinking in the world today. An alarming number of people are embracing crazy, even dangerous ideas. They believe that vaccinations cause autism. They reject the scientific consensus on climate change as a "hoax." And they blame the spread of COVID-19 on the 5G network or a Chinese cabal. Worse, bad thinking drives bad acting—it even inspired a mob to storm the U.S. Capitol. In this book, Steven Nadler and Lawrence Shapiro argue that the best antidote for bad thinking is the wisdom, insights, and practical skills of philosophy. When Bad Thinking Happens to Good People provides an engaging tour through the basic principles of logic, argument, evidence, and probability that can make all of us more reasonable and responsible citizens.

"*When Bad Thinking Happens to Good People* shows how we can more readily spot and avoid flawed arguments and unreliable information; determine whether evidence supports or contradicts an idea; distinguish between merely believing something and knowing it; and much more. In doing so, the book reveals how epistemology, which addresses the nature of belief and knowledge, and ethics, the study of moral principles that should govern our behaviour, can reduce bad thinking. Moreover, the book shows why philosophy's millennia-old advice about how to lead a good, rational, and examined life is essential for escaping our current predicament.

"In a world in which irrationality has exploded to deadly effect, *When Bad Thinking Happens to Good People* is a timely and essential guide for a return to reason." (From the Publisher)

More information available here.

Parshall, K. H. (2022). *The New Era in American Mathematics, 1920–1950*. Princeton, NJ: Princeton University Press.
ISBN: 978-0-691-23524-0

"As the Roaring Twenties lurched into the Great Depression, to be followed by the scourge of Nazi Germany and World War II, American mathematicians pursued their research, positioned themselves collectively within American science, and rose to global mathematical hegemony. How did they do it? The New Era in American Mathematics, 1920–1950 explores the institutional, financial, social, and political forces that shaped and supported this community in the first half of the twentieth century. In doing so, Karen Hunger Parshall debunks the widely held view that American mathematics only thrived after European émigrés fled to the shores of the United States.

"Drawing from extensive archival and primary-source research, Parshall uncovers the key players in American mathematics who worked together to effect change and she looks at their research output over the course of three decades. She highlights the educational, professional, philanthropic, and governmental entit-

ies that bolstered progress. And she uncovers the strategies implemented by American mathematicians in their quest for the advancement of knowledge. Throughout, she considers how geopolitical circumstances shifted the course of the discipline.

Examining how the American mathematical community asserted itself on the international stage, *The New Era in American Mathematics, 1920–1950* shows the way one nation became the focal point for the field." (From the Publisher)

More information available here.

Rhodes, R. (2021) *Scientist. E. O. Wilson: A Life in Nature*. New York, NY: Penguin Random House. ISBN: 978-0-385-54555-6

"Few biologists in the long history of that science have been as productive, as ground-breaking and as controversial as the Alabama-born Edward Osborne Wilson. At 91 years of age he may be the most eminent American scientist in any field.

"Fascinated from an early age by the natural world in general and ants in particular, his field work on them and on all social insects has vastly expanded our knowledge of their many species and fascinating ways of being. This work led to his 1975 book *Sociobiology*, which created an intellectual firestorm from his contention that all animal behaviour, including that of humans, is governed by the laws of evolution and genetics. Subsequently Wilson has become a leading voice on the crucial importance to all life of biodiversity and has worked tirelessly to synthesise the fields of science and the humanities in a fruitful way.

"Richard Rhodes is himself a towering figure in the field of science writing and he has had complete and unfettered access to Wilson, his associates, and his papers in writing this book. The result is one of the most accomplished and anticipated and urgently needed scientific biographies in years." (From the Publisher)

More information available here.

Sarasohn, Lisa T. (2021). *Getting Under Our Skin: The Cultural and Social History of Vermin*. Baltimore, MD: Johns Hopkins University Press. ISBN: 978-1-421-44138-2

"For most of our time on this planet, vermin were considered humanity's common inheritance. Fleas, lice, bedbugs, and rats were universal scourges, as pervasive as hunger or cold, at home in both palaces and hovels. But with the spread of microscopic close-ups of these creatures, the beginnings of sanitary standards, and the rising belief that cleanliness equaled class, vermin began to provide a way to scratch a different itch: the need to feel superior, and to justify the exploitation of those pronounced ethnically—and entomologically—inferior.

"In *Getting Under Our Skin*, Lisa T. Sarasohn tells the fascinating story of how vermin came to signify the individuals and classes that society impugns and ostracises. How did these creatures go from annoyance to social stigma? And how did people thought verminous become considered almost a species of vermin themselves? Focusing on Great Britain and North America, Sarasohn explains how the label "vermin" makes dehumanisation and violence possible. She describes how Cromwellians in Ireland and US cavalry on the American frontier both justified slaughter by warning "Nits grow into lice." Nazis not only labeled Jews as vermin, they used insecticides in the gas chambers to kill them during the Holocaust.

"Concentrating on the insects living in our bodies, clothes, and beds, Sarasohn also looks at rats and their social impact. Besides their powerful symbolic status in all cultures, rats' endur-

ance challenges all human pretensions. From eighteenth-century London merchants anointing their carved bedsteads with roasted cat to repel bedbugs to modern-day hedge fund managers hoping neighbours won't notice exterminators in their penthouses, the studies in this book reveal that vermin continue to fuel our prejudices and threaten our status. Getting Under Our Skin will appeal to cultural historians, naturalists, and to anyone who has ever scratched—and then gazed in horror." (From the Publisher)

More information available here.

Slotten, Hugh R. (2022). *Beyond Sputnik and the Space Race: The Origins of Global Satellite Communications*. Baltimore, MD: Johns Hopkins University Press.
ISBN: 978-1-421-44122-1

"On July 20, 1969, the world watched, spellbound, as NASA astronaut Neil Armstrong stepped off the Apollo 11 lunar module to walk on the moon. NASA estimated that 20 percent of the planet's population—nearly 650 million people—watched the moon landing footage, which was made possible by the first global satellite communications system, the International Telecommunications Satellite Organization, or Intelsat.

In Beyond Sputnik and the Space Race, Hugh R. Slotten analyses the efforts of US officials, especially during the Kennedy administration, to establish this satellite communication system and open it to all countries of the world. Locked in competition with the Soviet Union for both military superiority and international prestige, President John F. Kennedy overturned the Eisenhower administration's policy of treating satellite communications as simply an extension of traditionally regulated telecommunications. Instead of allowing private communications companies to set up separate systems that would likely primarily serve major "developed" regions, the new administration decided to take the lead in establishing a single world system. Explaining how the East-West Cold War conflict became increasingly influenced by North-South tensions during this period, Slotten highlights the growing importance of non-aligned countries in Asia, Latin America, and Africa. He also underscores the importance of a political economy of "total Cold War" in which many crucial aspects of US society became tied to imperatives of national security and geopolitical prestige.

"Drawing on detailed archival records to examine the full range of decision-makers involved in the Intelsat system, *Beyond Sputnik and the Space Race* spotlights mid- and lower-level agency staff usually ignored by historians. One of the few works to analyse the establishment of a major global infrastructure project, this book provides an outstanding analytical overview of the history of global electronic communications from the mid-nineteenth century to the present." (From the Publisher)

More information available here.

Coming HPS&ST Related Conferences

March 27-30, 2022, NARST Annual Conference, Vancouver, BC
Details: here.

July 3rd-7th, 2022, IHPST 16th International Conference, University of Calgary, Canada
Details from Glenn Dolphin:
glenn.dolphin@ucalgary.ca.

July 18-22, 2022, 'Objects of Understanding: Historical Perspectives on Material Artefacts in Science Education', Europa-Universität Flensburg, Germany

Details: Roland Wittje, roland.wittje@gmail.com and here.

July 24-29, 2023, 17th DLMPST Congress, University of Buenos Aires
Information: Pablo Lorenzano, pablo@unq.edu.ar.

HPS&ST Related Organisations and Websites

IUHPST – International Union of History, Philosophy, Science, and Technology

DLMPST – Division of Logic, Mathematics, Philosophy, Science, and Technology

DHST – Division of History, Science, and Technology

IHPST – International History, Philosophy, and Science Teaching Group

NARST – National Association for Research in Science Teaching

ESERA – European Science Education Research Association

ASERA – Australasian Science Education Research Association

ICASE – International Council of Associations for Science Education

UNESCO – Education

HSS – History of Science Society

ESHS – European Society for the History of Science

AHA – American History Association

ISHEASTME – International Society for the History of East Asian History of Science Technology and Medicine

BSHS – British Society for History of Science

EPSA – European Philosophy of Science Association

AAHPSSS - The Australasian Association for the History, Philosophy, and Social Studies of Science

HOPOS – International Society for the History of Philosophy of Science

PSA – Philosophy of Science Association

BSPS – The British Society for the Philosophy of Science

SPSP – The Society for Philosophy of Science in Practice

ISHPSB – The International Society for the History, Philosophy, and Social Studies of Biology

PES – The Philosophy of Education Society (USA)

The above list is updated and kept on the HPS&ST website HERE.

HPS&ST-related organisations wishing their web page to be added to the list should contact assistant editor Paulo Maurício (paulo.asterix@gmail.com)

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